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# United States Department of Agriculture,

## OFFICE OF EXPERIMENT STATIONS.

### THIRD REPORT OF COMMITTEE ON METHODS OF TEACHING AGRICULTURE.<sup>1</sup>

The committee on methods of teaching agriculture submits a third report of progress. The first report<sup>2</sup> contained a brief review of the courses of instruction in agriculture in American colleges and in a few foreign institutions and proposed a tentative plan for the division of agriculture. In its second report<sup>3</sup> the committee attempted to outline the subjects which should be included in a four years' course in agriculture, taking as a basis the subjects adopted by the Association as essential to all courses of like duration on the recommendation of its committee on entrance requirements.

The committee on teaching at that time also presented the following outline for the division of agriculture (in the narrower technical sense of that term as used in courses of study), as follows:

Agriculture (486 hours) shall include:

	Hours.
1. Agronomy, or plant production .....	132
2. Zootechny, or animal industry .....	162
3. Agrotechny, or agricultural technology .....	72
4. Rural engineering, or farm mechanics .....	60
5. Rural economics, or farm management .....	60
 Total .....	 486

In these reports the term "hours" is used in its scholastic sense for periods of class or laboratory work, and in reckoning the number of hours two hours of laboratory work or practicums are considered the equivalent of one hour of recitation.

In its second report the committee also declared its intention to take up next in detail the topics properly included under the head of "Agronomy," "with a view to presenting a syllabus of a course in that subject which shall show with some fullness the topics to be treated, their relative importance, the time which should be devoted to each, and especially the order of presentation which conforms most closely to sound pedagogical principles."

<sup>1</sup> Committee of the Association of American Agricultural Colleges and Experiment Stations, whose third report was presented to the convention of the Association held at Washington, D. C., November 15, 1898.

<sup>2</sup> See U. S. Dept. Agr., Office of Experiment Stations Bul. 41, p. 57, and Circ. 32.

<sup>3</sup> See U. S. Dept. Agr., Office of Experiment Stations Bul. 49, p. 29, and Circ. 37.

This purpose the committee has in a measure fulfilled by its work during the year and presents its report in three divisions, as follows:

- (1) A syllabus defining the limits of a course in Agronomy and stating the topics included in Agronomy in the order in which they should be presented to students, i. e., in their logical and pedagogical order.
- (2) A series of lecture or chapter headings showing how the syllabus for Agronomy may be applied in preparing a course of lectures or a text-book on this subject, covering 99 class-room hours or periods of 60 minutes each, i. e., three lecture or recitation periods a week.
- (3) A series of subjects for practicums or laboratory exercises to be used in connection with the class-room work in Agronomy and covering the 33 remaining hours or periods (equivalent to 66 hours of 60 minutes each) assigned to the course in Agronomy, i. e., one practicum per week.

It has been the object of the committee to make such an outline of this course as can easily be adjusted to the requirements of institutions with different organization and environment. While the syllabus is intended to limit the range of subjects which may properly be included under Agronomy, the amount of attention which shall be given to particular topics will vary according to circumstances. The series of chapters and practicums are in a measure intended simply to show a way in which the subject of Agronomy may be presented in actual practice. This is especially true of that portion of the course which relates to individual farm crops, to which attention will naturally be given according to their relative importance in different localities.

#### SYLLABUS OF COURSE IN AGRONOMY.

<b>Definition</b> .....	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; border-left: 1px solid black; padding-left: 10px; margin-right: 10px;"> <div style="display: flex; align-items: center;"> <span style="font-size: 1.5em;">{</span> </div> </div> <div>           Theory and practice of the production of farm crops.            In agronomy we need to consider the several kinds of plants grown as farm crops under the following subjects:         </div> </div>
<b>The plant</b> .....	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; border-left: 1px solid black; padding-left: 10px; margin-right: 10px;"> <div style="display: flex; align-items: center;"> <span style="font-size: 1.5em;">{</span> </div> </div> <div>           Structure (anatomy).            Composition.            Physiology.            Environment.         </div> </div>
<b>Plant production</b> ...	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; border-left: 1px solid black; padding-left: 10px; margin-right: 10px;"> <div style="display: flex; align-items: center;"> <span style="font-size: 1.5em;">{</span> </div> </div> <div>           In agriculture has for its object the adaptation of environment to the anatomy and physiology of the plants under cultivation, with a view to securing crops which are best suited to the uses of man or the domestic animals.         </div> </div>
<b>Environment</b> .....	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; border-left: 1px solid black; padding-left: 10px; margin-right: 10px;"> <div style="display: flex; align-items: center;"> <span style="font-size: 1.5em;">{</span> </div> </div> <div>           We may conveniently begin the study of plant production by considering the general characteristics of the environment of plants as grown in the field.         </div> </div>
<b>(General factors)</b>	<div style="display: flex; align-items: center; justify-content: space-between;"> <div style="flex-grow: 1; border-left: 1px solid black; padding-left: 10px; margin-right: 10px;"> <div style="display: flex; align-items: center;"> <span style="font-size: 1.5em;">{</span> </div> </div> <div>           Light.            Heat.            Moisture            Air            Soil ..... { Natural            With fertilizers         </div> <div style="border-left: 1px solid black; padding-left: 10px; margin-left: 10px;">           Plant food.         </div> </div>

But environment may be conveniently divided according to position, as follows:

<b>Environment</b> <small>(Divided according to position.) (Chapters I-III of lecture outline page 6.)</small>	1. Above ground (climate)	Light Heat Moisture Air	Study the relation of each of these factors to plant growth, and also briefly their effects in different combinations, i. e., different climates.
		Heat Moisture Air Earth (soil) Fertilizers	
<b>Soil</b> <small>(Chapters IV-XXXI.)</small>	2. Under ground (soil)	Heat Moisture Air Earth (soil) Fertilizers	Point out that the relation of these factors to plant growth may be most clearly perceived by first considering them in their relation to each other.
		Definition—Nature. Functions.	
<b>Soil</b> <small>(Chapters IV-XXXI.)</small>	Origin ...	Brief geological outline. Weathering of rocks. Accumulation of organic matter. Transformation of organic matter (nitrification and denitrification, etc.). Additions from atmosphere.	Classification of soils, on the basis of their properties.
		Properties ...	
<b>Soil</b> <small>(Chapters IV-XXXI.)</small>	Temperature. Air.	Chemical. Physical.	Classification of soils, on the basis of their properties.
		Weight Color Texture Capillarity Permeability Absorptive power	
<b>Soil</b> <small>(Chapters IV-XXXI.)</small>	Moisture ...	Sources Amounts	Water table. Hydroscopic moisture. Rainfall. Irrigation—Methods.
		Drainage ...	
<b>Soil</b> <small>(Chapters IV-XXXI.)</small>	Tillage ...	Conservation	Purpose and effects. Methods.
		Purpose and effects Methods	

**Soil—Continued** ....  
(Chapters IV-XXXI.)

Fertilizers	Definition.
	Methods and effects of action
Classification	1. According to constituents— a. Nitrogenous b. Phosphoric c. Potassic d. Other amendments.  2. According to form— a. Green manures b. Animal manures c. Commercial—classify principal forms.
	(Study first the general theory of fertilizers according to above scheme and then consider in as much detail as may be deemed desirable different kinds of fertilizers, using Schedule A.)
	SCHEDULE A.
Kinds of fertilizers	Name. Description.  Properties
	Place in classifications. Sources. Uses. Preparation, care, and handling. Application.
	Effects
	Economy
Waste and renovation	Washing. Transportation by wind and water. Leaching. Oxidation. Cropping—rotation of crops—systems of farming.

Having considered in a general way the theory and practice of plant production as related to the structure, physiology, and environment of the plants grown as farm crops, we come next to consider the production of different kinds of crops more in detail.

**Farm crops** -----  
(Chapters XXXI-  
XXXIII.)

Classification -----

(The classification and the kinds of plants to be named under each class will vary according to circumstances.)

Methods of improvement ----- { Breeding.  
Selection.

Next study individual farm crops according to the following scheme:

Name.

Place in classification.

Structure.

Composition.

Physiology.

Botanical relations.

Varieties ----- { Classification.  
Improvement.

Geographical distribution.

Culture ----- { Choice and preparation of soil.  
Manuring.  
Seeds (or other parts of plants used for planting)—selection—amount—treatment.  
Planting.  
Cultivating.  
Place in rotation.

Harvesting.

Preservation.

Uses.

Preparation for use.

Obstructions to growth, preservation, or use. { Weeds  
Fungi  
Bacteria  
Insects  
Birds  
Quadrupeds } Means of repression.

Production.

Marketing.

History.

**Individual farm crops.**

(Chapters XXXIV-LXI.)  
(The crops to be studied will vary according to locality and other circumstances.)

## OUTLINE FOR A COURSE OF LECTURES OR A TEXT-BOOK ON AGRONOMY.

(The lectures are intended to cover 99 hours.)

Chapter	<ul style="list-style-type: none"> <li>I. General Climatic Conditions.</li> <li>II. Plant Food and Growth.</li> <li>III. Air as a Source of Plant Food.</li> <li>IV. The Nature, Functions, Origin, and Wasting of Soils.</li> <li>V. Properties of Soils, Chemical and Physical. Classification, Texture, Composition, and Kind of Soils.</li> <li>VI. Physics of Soils as Related to Plant Growth (Capillarity, Solution, Diffusion, and Osmosis).</li> <li>VII. Soil Temperature.</li> <li>VIII. Relation of Air to Soil.</li> <li>IX. Soil Water.</li> <li>X. Irrigation.</li> <li>XI. Improvement of Soil Through Drainage.</li> <li>XII. Drainage Methods.</li> <li>XIII. Conservation of Soil Moisture.</li> <li>XIV. Physical Effects of Tillage.</li> <li>XV. Chemical and Biological Effects of Tillage.</li> <li>XVI. Methods of Tillage.</li> <li>XVII. Do.</li> <li>XVIII. Fertilizers—Methods and Effects of Action.</li> <li>XIX. Fertilizers—Classification by Constituents and Form.</li> <li>XX. Sources and Uses of Nitrogen.</li> <li>XXI. Sources and Uses of Phosphoric Acid.</li> <li>XXII. Sources and Uses of Potash.</li> <li>XXIII. Sources and Uses of Other Amendments.</li> <li>XXIV. Practical Advice on the Use of Commercial Fertilizers.</li> <li>XXV. Humus and Green Manuring.</li> <li>XXVI. Animal Manures. General Statements.</li> <li>XXVII. Manures Produced from Various Animals.</li> <li>XXVIII. Care, Preservation, and Application of Manures.</li> <li>XXIX. Waste and Renovation of Soils.</li> <li>XXX. Rotation of Crops. General Statements.</li> <li>XXXI. Rotation of Crops. Systems of Farming.</li> <li>XXXII. Farm Crops—Classification; Production; Reasons for Choice.</li> <li>XXXIII. Improvement of Farm Crops.</li> <li>XXXIV. Wheat—Structure, Composition, and Varieties.</li> <li>XXXV. Wheat—Culture, Harvesting, and Preservation.</li> <li>XXXVI. Wheat—Obstructions to Growth, Preservation, and Use.</li> <li>XXXVII. Wheat—Production, Marketing, History.</li> <li>XXXVIII. Corn.</li> <li>XXXIX. Corn.</li> <li>XL. Corn.</li> <li>XLI. Corn.</li> <li>XLII. Rice.</li> <li>XLIII. Oats.</li> <li>XLIV. Barley and Rye.</li> <li>XLV. Grasses.</li> <li>XLVI. Grasses.</li> <li>XLVII. Clovers.</li> <li>XLVIII. Pastures.</li> <li>XLIX. Silage.           <ul style="list-style-type: none"> <li>L. Forage Crops.</li> <li>LI. Potatoes.</li> <li>LII. Potatoes.</li> </ul> </li> <li>LIII. Root Crops: Mangels, Beets, Turnips.</li> <li>LIV. Sugar Plants: Sugar Beets.</li> <li>LV. Sugar Plants: Cane, Sorghum, etc.</li> <li>LVI. Fiber Plants: Cotton.</li> <li>LVII. Fiber Plants: Cotton.</li> <li>LVIII. Fiber Plants: Flax, Hemp, Jute, Rammie, Sisal, etc.</li> <li>LIX. Stimulants: Tobacco, Tea, Coffee.</li> <li>LX. Medicinal and Aromatic Plants.</li> <li>LXI. Miscellaneous Plants: Buckwheat, Broom Corn, Peanuts, Hops, Canaigre, etc.</li> </ul>
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[The order of discussion of the different crops will be the same as in the case of wheat. The details to be given for each crop will vary with the importance of the crop in any region.]

## PRACTICUMS OR LABORATORY WORK IN AGRONOMY.

(The practicums are intended to cover 33 laboratory periods, i. e., 66 hours.)

1. Determination of specific gravity of soils.
2. Determination of volume weight of soils.
3. The power of retaining moisture in the soil in its highest degree of looseness.
4. The power of retaining moisture in the soil when compacted.
5. Rate of percolation of water through soils.
6. Rate of percolation of air through soils.
7. Effect of mulches upon evaporation of water from soils.
8. Behavior of soils toward gases.
9. Capillary attraction in soils.
10. Determination of cohesion in soils.
11. Mechanical analysis of soils.
12. Do.
13. Study of root systems of principal crops.
14. Do.
15. Do.
16. Study of varieties of corn in field.
17. Scoring ears of corn.
18. Study of effect of fertilizers on one or more crops in fall.
19. Study of effect of fertilizers on one or more crops in early spring.
20. Study of effect of fertilizers on one or more crops near harvest.
21. Study of varieties of wheat in sheaf and by sample.
22. Do.
23. Study of varieties of wheat in field.
24. Study of varieties of oats or other grain in sheaf and by sample.
25. Study of varieties of oats or other grain in field.
26. Study of varieties of potatoes by sample.
27. Study of varieties of potatoes in field.
28. Study of varieties of grasses and forage crops in field in fall.
29. Study of varieties of grasses and forage crops in field in early spring.
30. Study of varieties of grasses and forage crops near harvest in field.
31. Study of varieties of grasses and forage crops by sample and preparation of abstracts of station experiments on climatic and soil conditions and upon quality and yield.
32. Do.
33. Do.

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Recommended for publication.

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Publication authorized.

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